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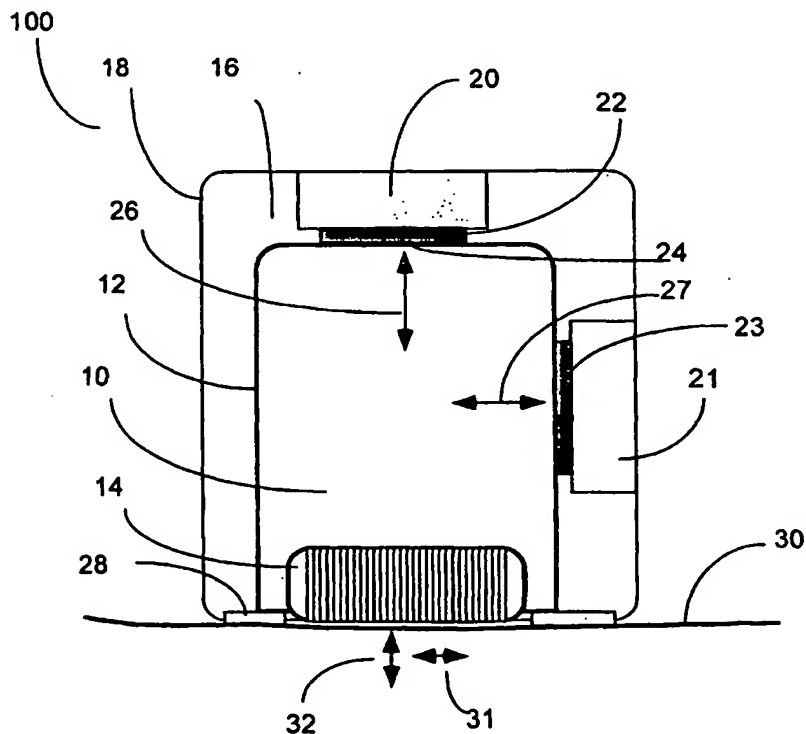
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(54) Title: EPILATION METHOD AND DEVICE



(57) Abstract: A method and device (100) are presented for improving a hair removal process performed by a hair removal system. A hair to be removed is selected, and vibrations of predetermined frequency, amplitude and power are generated and transmitted to a treatment zone. The vibrations of the treatment zone are maintained for a time sufficient to cause a desired effect at the treatment zone. The desired effect includes at least one of the following effects: loosening, destruction, degeneration or fatigue of at least a part of the treatment zone, and hampering of the morphology or physiology of at least one component of the treatment zone.



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## EPILATION METHOD AND DEVICE

### 5 FIELD OF THE INVENTION

The present invention is generally in the field of hair epilating techniques, and relates to a device and method for improving a hair removal process performed by a hair removal system.

### 10 BACKGROUND OF THE INVENTION

Various hair depilatory devices and methods for the removal of hair are known. Wax-based preparations are used to remove body and facial hair, and include both cold and hot wax preparations.

In recent years, a variety of electrically or manually operated hair depilation  
15 devices based on hair plucking have been developed .

U.S. Patent No. 5,908,425 discloses a hand-held, manually operated depilatory device which removes hair located along the length of a linear axis. A string-like elongated element is positioned within the frame, and hair is engaged and captured by the moving twisted engagement of this element and pulled away.

20 U.S. Patent No. 5,112,341 discloses a hair removal device having a multiple- tweezers element arranged to pluck hair by the plucking motion of a set of movable twist tweezers, which work in a continuously repetitive fashion. Preferably, the hair-plucking element comprises a set of disc-shaped tweezers elements which are in a fixed position, and an interleaved set of disc-shaped  
25 movable tweezers elements mounted on a central shaft. The spaces formed between the elements are repetitively opened and closed by the sliding motion of the shaft against a cam which drives the movable elements in both directions in relation to the fixed position tweezers, in order to trap and pluck out hair.

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EP 287 976 discloses an epilating appliance having a tweezers arrangement which opens and closes in an oscillating fashion. The tweezers arrangement oscillates in the direction towards and away from the hand-held supporting device, so that the gripping devices are adapted to approach the skin's surface in a spread  
5 apart position for receiving the hair. When in the proximity of the skin, these gripping devices are movable to the gripping position in which they clamp the hair, and when in the closed position, the gripping devices withdraw away from the skin, and the hair is thus plucked out in the process. Then, in the range of the retractive position, the gripping devices move again to the spread apart position in which hair  
10 is ejected and additional cycles of removal of hair may be initiated.

Examples of such epilating devices are described, for example, in US Patent Nos. 5,7094,935; 5,857,903; 5,899,900; 5,867,908; 5,901,446; US 5,899,900; US 4,940,466; USD 0392412 and the like.

Most prior art depilatory devices are based on the concept of plucking out  
15 hair by a single plucking motion, i.e. gripping the hair, and pulling it away from the skin (which pulling may be abrupt or continuous). By this single-plucking technique, the hair shaft is either plucked together with its roots or torn therefrom.

Additionally, most hair removal techniques, including mechanical epilation, the removal of hair by laser, the removal of hair by RF, electrodepilation,  
20 microwave epilation etc., involve some amount of pain, tingling or discomfort. To date, the most common means for reducing this discomfort is by the local application of various topical analgesics, by cooling the region to be treated or by performing some sort of gentle massage during the epilation process in order to reduce the pain.

## 25 SUMMARY OF THE INVENTION

There is accordingly a need in the art to improve conventional hair epilating techniques by providing a novel device and method capable of being used with any known hair removal system.

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It is a major feature of the present invention to provide such a device that, whilst utilizing any known hair removal system, improves its efficiency, expands the longevity of the non-hairy period or decrease hair growth rate following the hair removal process, and reduce pain caused by pulling out hairs and/or destruction of hair roots during the hair removal process.

The main idea of the present invention consists of subjecting a treatment zone to vibrations by using a vibration generator associated with a hair selecting mechanism (e.g., a hair gripping mechanism), therefore vibrating any of, or several parts of the hair, hair follicle or hair supporting element, or the skin around hairs to be treated with epilatory device. The hair selecting mechanism is of a kind enabling selection of a hair to be removed by mechanical gripping of the hair, by affecting the hair by energy transfer, etc., and may be part of a conventional hair removal system. In other words, the vibration generator may be coupled to, installed in or contain a conventional hair removal system. Alternatively, the vibration generator together with the hair selecting mechanism may be a stand-alone device that may and may not be used with another non-mechanical hair removal system. The treatment zone shall include any hair component, skin portion around the hair to be removed, and/or any of the hair supporting elements.

The term "*hair component*" used herein signifies the hair root and/or hair shaft, while the term "*hair supporting element*" signifies any one of the following: the hair follicle, the papilla, the blood supply to the hair, hair nervation, bulge, as well as the small muscles attached thereto in proximity to the hair root or any other morphological structure or physiological activity which contribute to the vitality of the hair. The term "*hair removal process*" used herein signifies a process aimed at reducing degree of attachment of the hair shaft to the hair root, of the hair root to the hair supporting element, and/or of the hair supporting element to its surrounding tissues. This process ends either with the physical plucking of at least a portion of the hair component (e.g., at least a portion of the hair shaft), or with the creation of such condition of the hair attachment or hair vitality to cause its falling out.

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According to the invented method, the vibrations at least partly reach the hair shaft, the shaft-root interconnecting zone, the hair root, the hair follicle or its surroundings to cause a desired effect, namely, loosening or destruction, possibly fatigue, of any of these elements or their interconnecting zones. The vibrations can  
5 further reach the skin surface, or the basal hair zones, and repeated mechanical vibrations at the skin surface can further alter the threshold of pain, i.e., elevate the threshold of pain, and therefore reduce or eliminate pain caused by the hair removal process. The reduction of pain during plucking might be obtained also by the loosening of the intercellular zone due to the vibrations transferred via the hairs it  
10 selves.

The vibration process is preferably carried out concomitantly with the regular hair removal process performed by a hair removal system, which may be of any known kind utilizing mechanical epilation (e.g., a hair gripping device capable of plucking), electroepilation, laser/light epilation, microwave epilation, etc. It  
15 should however be noted that the vibration process can also be carried out either before or after the application of any known hair removal process. The introduction of these vibrations provides high efficient, long lasting non hairy period or slower growth rate, and/or markedly reduced pain epilation.

In other words, vibration of the hair, any of its sub-components, or the skin  
20 around it may be carried out using virtually any known epilation device together with a vibration enabling means coupled to this device, or installed therein or working in parallel (e.g., where laser-based epilation device is used). This vibration enabling means may utilize acoustic (e.g., transducer), mechanical (e.g., eccentric motor), hydraulic or pneumatic (e.g., piston) means as well as similar devices.  
25 These vibrations should be of an appropriate frequency, displacement amplitude, power and duration to cause a desired effect, i.e., improved epilation, longer lasting non hairy period, reduced growth rate and there combination, and preferably also numbing or light anesthesia of the epilation treated zone.

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There is thus provided, according to one aspect of the present invention, a method for improving a hair removal process performed by a hair removal system, the method comprising the steps of:

- (a) selecting a hair to be removed;
- 5 (b) generating vibrations having predetermined frequency, amplitude and power, and transmitting said vibrations to a treatment zone;
- (c) maintaining said vibrations of the treatment zone for a time sufficient to cause a desired effect at the treatment zone.

As indicated above, the desired effect consists of improving the epilation  
10 process, prolonging its effect, reducing further hair growth rate and/or numbing, or partial numbing, of the treatment zone.

The hair selection may be performed by utilizing a mechanical hair removal system having an effective epilating compartment, composed, for example, of rotating disks or spring, capable of gripping the hair. The frequency of the  
15 vibrations is preferably higher than the operational frequency of the hair removal system (i.e., its active epilating compartment) by at least one order of magnitude, e.g., when a mechanical epilation device of 100 or 600Hz frequency is used, the frequency of the vibrations should preferably be at least 1000 or 6000Hz respectively. The vibrations of a stand-alone type device (i.e., an independent  
20 device formed of the vibration generator and the hair gripping mechanism, whose operation is irrespective of the operation of any other hair removal system, if used) are typically with the frequency in a range from 10Hz to 100kHz, and preferably in the frequency range of 50Hz to 10kHz, and most preferably in the range of 100Hz to 1000Hz. The amplitude should preferably be above 50 $\mu$ m. It should, however,  
25 be noted that tradeoff of parameters exists, e.g., when higher frequency is used, compensation can be done concerning the amplitude, etc.

As for the duration of the vibration transmission, it preferably does not exceed the duration of the epilation process performed by the hair removal system (i.e., is either shorter, or substantially equal thereto). This period of time actually  
30 depends on the desired effect. In the case of a stand-alone type device, the

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vibrations are transmitted during the time period of second-parts till seconds. The minimum supply power required to achieve the desired effect is preferably in the range of single Watts or Watt parts.

Thus, the vibrations may be transmitted to the treatment zone immediately  
5 before, during or after the hair removal process carried out by the hair removal system, but preferably concomitantly with the hair removal process.

According to another aspect of the present invention, there is provided a device for improving a hair removal process performed by a hair removal system, the device comprising a hair selecting means for affecting the hair to be removed,  
10 and a vibration generator that generates vibrations having predetermined frequency, amplitude and power, and transmits said vibrations to a treatment zone, such as to cause a desired effect at the treatment zone.

As indicated above, the hair gripping means may and may not be part of a hair removal system. This is relevant for such cases when the epilation device  
15 according to the invention is to be used with the conventional mechanical hair removal system. However, should the invented device be used for instance with a laser or microwaves based epilation system, which do not have means for gripping hairs, the device according to the invention is capable of gripping hairs with its own hair gripping means.

20 Thus, according to yet another aspect of the present invention, there is provided a vibration generator engageable with a mechanical hair removal system, having a hair gripping means and an effective epilation compartment, the vibration generator being capable of generating vibrations of predetermined frequency, amplitude and power, and transmitting said vibrations towards a treatment zone, so  
25 as to cause a desired effect at the treatment zone.

The hair removal systems suitable to be used in the epilation device according to the invention may include mechanical epilators and shavers, RF hair removals, electroepilation devices, microwave epilation, laser or light epilatory devices, etc. Such hair removal systems may, for example, be those developed by



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Braun, Philips Corporation, Remington Corporation, disclosed in the above prior art patents.

The vibration generator comprises at least one vibration element, and optionally, at least one transmitting unit. The vibration element may be of any  
5 known suitable kind utilizing, for example, as acoustic (e.g., transducer), mechanical (e.g., eccentric motor), hydraulic or pneumatic (e.g., piston) means, etc.

When using the vibration generator with the mechanical hair removal system, the operation of the vibration generator preferably causes vibrations of at least the active compartment of the hair removal system, or of its close proximity.  
10 These vibrations are transferred to the shaft of the treated hair, and further to the other hair components to create the desired effect.

The effective epilation compartment of the mechanical hair removal system may be of a kind comprising spaced-apart parallel rotation disks, the spaces or gaps between the adjacent disks serving for trapping of hairs therein, thereby enabling  
15 clamping of the hairs. The disk's rotation after clamping the hair causes plucking of the hair shaft, or entire hair, out of the follicle. According to the present invention, the trapped hair is subjected to vibrations, prior to and/or whilst being plucked, using the vibration generator. To this end, the vibration generator preferably causes vibrations of at least the effective component of the plucking device, and further  
20 causes vibrations of the clamped hair. In other words, the hair is vibrated during the process of clamping the hair between the disks, and is further vibrated, whilst being clamped. This may significantly enhance the efficiency of the hair removal process, and concomitantly reduce pain caused by the effects of clamping and plucking.

Due to the vibrations applied to the treatment zone, plucking itself is easier  
25 and less painful, owing to the initial loosening of zones between the treated hair and its surroundings. Furthermore, the unplucked hair components suffer from further additional damage resulting from the repeated vibration, delaying the hair recovery and re-growth, resulting in the longevity of the non-hairy period or slower growth rate. At the same time, in addition to the reduction of pain associated with  
30 the loosening of the hair surroundings, also the repeated vibrations at the skin

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surface increase the threshold of pain, further contributing to a less painful procedure

Preferably, the hair is plucked with the hair removal device, during, or after the transmission of the vibrations to the hair.

5 The vibration process is carried out for sufficient time to cause loosening or destruction, e.g., enlargement of intercellular spaces or fatigue respectively, of any or several of the vibrated hair components, or areas adjacent to the vibrated components. Vibration of the effective compartment of the hair removal system, during and in addition to its regular operation, further improves the efficiency of  
10 the hair plucking due to loosening of tissue and/or fatigue associated with the pre-plucking periodic vibration of the treated hair. It further weakens the hair-root, the root-follicle or the follicle-dermal connection, together with other degenerative effects, thereby enabling easier and longer lasting hair epilation with the hair removal system. The effect of the repeated vibration might be further attributed to  
15 heating, possible cavitation and denaturation or potential ablation. In addition, the repeated high frequency vibration, having the appropriate characteristics, reach the skin surface, either directly or via the hair shafts, and cause anesthesia/numbing of the skin surface (treatment zone). Preferably, vibrations are transmitted in a direction along the long axis of the hair, to omit losses at interface with the skin.

20 The desired effect (efficient, long lasting as well as pain reduced hair removal process and slower growth rate) can be carried out using one of the following implementations of the device:

A. Both, the vibration generator and the hair removal system are installed in a common vibrating housing.

25 In this case, the transmission of the vibrations through the housing causes vibrations of the entire hair removal system. thereby enabling desired vibrations of at least the hair trapped by this hair removal system. During this operation, the vibrations might further reach and affect the skin surface, thereby also elevating the threshold of pain. In this specific implementation of the device, the desired effect  
30 can be also achieved by vibrating a rim-like zone around the hair removal system at

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an area adjacent to the treatment zone. Similar phenomena could be achieved by the vibrations transmitted via hairs to affect nerves.

B. The vibration generator is installed in the hair removal system.

This enables to vibrate the effective epilation component of the hair removal  
5 system attached to the skin. Here, hairs are vibrated after being trapped and before being removed (e.g., plucked out of the skin), and this vibration may affect also the skin surrounding the treated hairs.

C. The vibration generator is an auxiliary unit.

In this case, the vibration of hairs is carried out independently of the hair  
10 removal system. The vibration generator itself is provided with a suitable hair selecting means for affecting (e.g., gripping) the selected hair and providing its vibration, preferably without any active mechanical epilation process. An example for this way of operation might be a laser epilation treatment accompanied by the operation of the device according to the invention.

15 Occasionally, pretreatment of the hairs to be treated or the skin might be required, for instance stretching the skin or cleaning the skin surface to reduce absorption of the mechanical energy in the skin. The procedure of vibration itself is preferably performed on tensioned hairs, and therefore another pretreatment to be performed might consist of adding gels to tension the hairs or gripping and slightly  
20 pulling the hairs to give them some tension.

Occasionally, the same unit used to activate the epilating part of the epilation device can be used also to vibrate the epilating part of the said epilation device (using appropriate transmission parts), i.e., without installment of further mechanical means for vibration, but only certain additives. For instance, a motor  
25 used to cause rotation of the active part of the epilation device to initiate plucking of hairs, can be used utilizing for example an eccentric component, also to vibrate the active part, and thereby to increase the efficiency and longevity of epilation as well as to sedate/reduce pain caused by the epilation process. However, when a hair removal system having no mechanical vibration means is used, implementation  
30 of a vibration-enabling means is required.

The case may be such that, during a part of the epilation process or during the entire process, a vibrating component of the epilation device should be at least partially isolated from the skin. For this purpose, the epilation device may be formed with a spacer to be appropriately located between the vibrating component  
5 and the patient's skin, when putting the device in operation (i.e., applying the activated device to the skin). The spacer does not affect the gripping or the actual vibration of the hair, but serves as a buffer preventing vibrations of the vibrating component from reaching the skin, yet allowing them to run via the hairs. Such a spacer can be used also to grip hairs.

## 10 BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, a preferred embodiment will now be described, by way of a non-limiting example only, with reference to the accompanying drawings, in which:

**Figs. 1 and 2** are schematic illustrations of two different examples of an  
15 epilation device according to the invention aimed at increasing efficiency of the epilation process, and decreasing pain utilizing a mechanical hair gripping or hair removal device installed in a vibration generator;

**Fig. 3** is a schematic illustration of an epilation device according to the invention, utilizing a mechanical hair gripping or hair removal device, with a  
20 vibration generator installed therein;

**Figs. 4A to 4D** schematically illustrate the main components of an epilation device according to the invention, utilizing an electro-epilation system associated with a vibration generator;

**Fig. 5** is a schematic illustration of an epilation device according to the  
25 invention, utilizing a laser/light epilation device associated with a vibration generator;

**Fig. 6** is a schematic illustration of an epilation device according to the invention, utilizing an RF epilation device associated with a vibration generator;

**Figs. 7A to 7D** schematically illustrate an improved spring-based epilation device according to the invention;

**Figs. 8A to 8F** schematically illustrate an epilation device according to the "*hair disconnecting aspect*" of the invention;

5       **Fig. 9** is a schematic illustration of one more embodiment of an epilation device according to the invention;

**Figs. 10A and 10B** schematically illustrate a hair removal device according to the invention, in two different operational positions of its gripping device, respectively; and

10       **Figs. 11A-11F** schematically illustrate a hair gripping and skin stretching device according to the invention.

#### **DETAILED DESCRIPTION OF THE INVENTION**

Referring to Fig. 1, there is illustrated an epilation device **100** constructed and operated according to one embodiment of the invention, aimed at increasing  
15 the efficiency of the hair removal process. The device **100** comprises such main constructional parts as a hair gripping device **10** (constituting a hair selecting means for affecting a selected hair to be removed) and a vibration generator **16**. The hair gripping device may be of any known kind typically formed with an effective epilating compartment **14** accommodated in a housing **12** with a portion of the  
20 compartment projecting from the housing towards skin **30**. It should be noted that the device **10** could be any mechanical hair removal device, for example those commercially available from Philips, Braun etc.

The vibration generator **16** is engageable with the hair gripping device **10**. To this end, a housing **18** of the vibration generator **16** may be formed with a  
25 groove (not shown) shaped and dimensioned so as to enable the mounting of the housing **12** in the groove.

The vibration generator **16** is composed of at least one vibration element – two vibration elements **20** and **21** being shown in the present example. These vibration elements transmit vibrations to the hair gripping device **10** (or hair

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removal device) to cause its vibrations along corresponding axes, shown as arrows 26 and 27, respectively. It should, however, be noted that the provision of the second vibration element, e.g., the element 21, is optional.

As further shown in the figure, transmission units 22 and 23 are provided for  
5 transmitting vibrations from the elements 20 and 21, respectively, to the hair gripping or hair removal device 10. However, the provision of these transmission units is optional, and the vibrations may be transmitted directly from the elements 20 to the hair gripping device 10 via an attachment zone 24 (and that associated with the element 21, as the case may be).

10 Further provided in the device 100 is a vibration absorber 28 attachable to the skin 30, so as to absorb vibrations of the housing 18 during the operation of the apparatus 100. The absorber 28 is preferably located at the interface between the housing 18 and the hair gripping device 10.

When the device 100 is put in operation, the vibrations generated by the  
15 element 20 and/or element 21 are transmitted through the device 100. The transmitted vibrations concomitantly affect all parts of the entire epilation device 100, including its active epilating compartment 14 and the housing 18 of the vibration generator. The vibrations of the compartment 14 are at least partly transferred to hairs (not shown) in the direction marked as arrows 32 and 31  
20 (corresponding, respectively, to the elements 20 and 21). These affected hairs are those which are gripped by the compartment 14 during the regular epilation process. As for the vibrations of the housing 18, they are absorbed in the vibration absorber 28. The provision of two vibration elements 20 and 21, if put together, causes the vibrations of the compartment 14 in two mutually perpendicular  
25 directions 32 and 31, thereby enhancing its movement.

Fig. 2 illustrates an epilation device 200, which, similarly to the previous example of Fig. 1, is aimed at reducing pain caused by the epilation process. The device 200 is constructed generally similar to the device 100 of Fig. 1, but differs

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therefrom in that its effective epilating compartment is only partly vibrated by a vibration generator.

Thus, the device 200 comprises a hair gripping device (or a mechanical device for hair removal) 35, which may be of any known kind (e.g., the same  
5 device 10 of Fig. 1 can be used), and a vibration generator 41. The hair gripping device 35 is composed of a housing 37 carrying an active epilating compartment 39. To provide appropriate engagement between the hair gripping device 35 and the vibration generator 41, a housing 43 of the vibration generator 41 may be formed with a groove, which is not specifically shown. A vibration element 45, which is  
10 attached to the housing 43 thereinside, generates vibrations and transmits them towards the hair gripping device 35, either directly or via a transmission unit 47.

According to the present example, a guiding unit 49 in the form of arms or plates is located inside the housing 43 being interposed between the vibration element 45 (or transmission unit 47, as the case may be) and the housing 37 of the  
15 hair gripping device 35. Preferably, the arms or plates 49 surround the hair gripping device 35. The transmitted vibrations are guided by the unit 49 towards its lower portion 51 that further transfers the vibrations in the direction shown by arrows 57. These vibrations affect the portion of skin 55 within the zones 53 of direct contact between the device 200 and the skin. These zones preferably form a rim  
20 surrounding the hair gripping device 35, and the active epilating compartment 39 of the device 35 thereby always passes an area previously sedatively treated, i.e., an area similar to that defined by the zones 53.

Reference is now made to Fig. 3, illustrating an epilation device 300 utilizing a hair gripping device with a vibration generator installed therein. The hair  
25 gripping device may be of any known kind, including an effective epilation compartment 64 and a driving compartment 60 (containing for instance all electronic circuits required for the device operation) which are accommodated in a common housing 62. The vibration generator is composed of two vibration elements 68 and 69 (the provision of only one of them being sufficient for the

device operation), associated with transmission units 72 and 73 (whose provision is optional) and supported inside the housing 62 by supporting elements 70 and 71, respectively. Vibrations generated and transmitted by the vibration elements 68 and 69 are transmitted to the compartment 64 via a further transmission unit 74, which  
5 may be part of the original hair gripping or hair removal device. The vibrations reaching the compartment 64 cause its movement in two mutually perpendicular directions, shown as arrows 76 and 77. As shown, the device 300 also comprises buffers or spacers 79 interposed between the bottom side of the housing 62 and skin 66 in a manner to surround the active compartment 64.

10 The above-described devices 100, 200 and 300 exemplify the epilation devices aimed at improving a conventional mechanical epilation device (hair gripping device and/or hair removal device) by providing it with a vibration generator, which can either be coupled to the hair gripping device or be integral therewith.

15 Turning now to Figs. 4A-4D, an epilation device 400 is illustrated, which utilizes an electro-epilation system (rather than a mechanical epilation system) and a vibration generator. The electro-epilation system might be of a known kind, composed of an electro-epilation needle 180 mounted within a central slot of a cylindrically shaped housing 190 and supported by support elements 191. The  
20 needle 180 is by its distal end 182 insertable into a hair follicle 184 towards the hair root 188.

Figs. 4A and 4C illustrate, respectively, a front-section view and a top-section view (taken along line I-I) of the device 400 in its initial, ready to hair removal position. Figs. 4B and 4D illustrate, respectively, a front-section view and  
25 a top-section view (taken along line II-II) of the device 400 in its operative position, the needle 180 being inserted into the hair follicle 184, the hair shaft 181 being trapped.

The vibration generator is composed of a vibration element 189, such as acoustic transducer, coupled to a vibrating element 196 (optionally, via a  
30 transmission unit 195) extending towards a skin surface 186 and serving also for



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transmitting vibrations to the skin surface 186. As shown, the element 192 is substantially of an annular shape surrounding the needle portion 180 and defining an annular space 193 therebetween for a hair shaft 181 to be inserted therein and gripped by gripping arms 192. The latter, when in inoperative position thereof  
5 (without gripping hairs), are movable within an outer margin of a gripping area defined by an annular space 194 between the inner wall of the housing 190 and the outer wall of the vibrating element 196. The needle 180 and the vibration generator (vibration element 189) are coupled to a power source (not shown) through wires 197 to be electrically supplied.

10 When the needle (by its distal end 182) is inserted into the follicle 184 (Fig. 4B), the vibrations generated and transmitted by the vibration generator reach the skin surface 186 thereby performing a massage of the skin surface in the direction along the axis of vibration shown by arrows 198. This massage effect reduces pain caused by the hair gripping procedure. The vibrations are also transmitted to the  
15 hair root 188 causing its movement in the direction along the axis of hair vibration, shown as arrow 199. This increases intra-follicular alterations and facilitates the hair removal.

Fig. 5 illustrates an epilation device 500 utilizing the principles of light/laser epilation. The device 500 comprises a light source (not shown) generating a plurality of light beams, generally at 92, and directing them onto a skin surface 94.  
20 Irradiated beams 92 might also be microwaves. A vibration generator is composed of a vibrating element 80, such as acoustic transducer, and a transmission unit 82, for example in the form of an acoustic horn and tip. Mounted on the distal end of the tip is a gripping element 84. That portion of the device which is brought into  
25 direct contact with the skin surface 94 is formed with a spacer or buffer element 86 aimed at preventing the transmitted radiation, e.g., acoustic waves, from reaching the skin surface. The transmission unit 82, gripping element 84 and buffer element 86 could be made of a material transparent for the incident light (or the incident microwaves, as the case may be). During the operation of the device, the hair shaft

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87 is gripped by the element 84, and the vibrations of this element are transmitted to the hair root 88 and papillae 90. The repeated vibrations facilitate the thermal effect caused by the irradiated light or microwaves.

Fig. 6 illustrates the main components of an epilation device 600 utilizing  
5 RF radiation. The device 600 comprises a tweezers 112, covered by isolation 114, with pivotal arms about an axis 110. Front sides 106 and 108 of the tweezers arms 112 define opposite walls 102 and 103, respectively, of a hair holding compartment.

A vibration generator is accommodated in a handle of the device formed with an insulation cover 120, and is composed of a vibrating element 118 (e.g., as  
10 acoustic transducer) coupled to the original source of an RF transmitting unit 116, and supported by a support element 124, and a further transmission unit 122 that transmits both the RF signals and vibrations. The leading edge of the tweezers intended to be brought in contact with skin is formed with a buffer element 104. According to this specific example, a hair shaft (not shown) located between the  
15 opposite walls 102 and 103 is affected by the vibrations, in addition to the RF effect, if any, to facilitate the hair removal process.

Following are some more examples of epilation devices whose operation can be significantly improved by providing them with a vibration generator according to the invention.

20 Figs. 7A-7D illustrate a spring-based epilation device 700. Figs. 13A and 13B are bottom views of two different implementations of the device, with and without the use of a buffering spacer 134, respectively, to contact a skin surface 140. To facilitate understanding, the same reference numbers are used for identifying those components, which are common in these two examples. Figs. 7C  
25 and 7D are section views of the devices of Figs. 7A and 7B, respectively, taken along the lines I-I and II-II (of Figs. 7A and 7B respectively).

The main constructional and operational principles of the spring-based epilation device are known *per se* and therefore need not be specifically described, except to note the following. A spring 132 is held by an appropriately designed flat  
30 tip 130 having its end portion 135. The spring 132 is preferably round, and is

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pressed within the mould of tip. For the purposes of the present invention, the device 700 is formed with a screw area 136 to be attached to a horn (not shown). However, the element 136 might also be an acoustic transducer.

Figs. 8A-8F illustrate an epilation device 800 according to another embodiment of the invention. Figs. 8A and 8B are bottom views of the device, showing two different operative positions of the device with discs 154 being opened and closed, respectively. Figs. 8C and 8D are side views of the device 800 corresponding to the positions of Figs. 8A and 8B. Figs. 8E and 8F more specifically illustrate the discs 154 in their opened and closed positions, respectively.

As shown, the discs 154 are arranged in a spaced-apart parallel relationship and are associated with a flat disc runner 152 that keeps the discs in the correct orientation. During the operation of the device, a hair 162 becomes inserted into the space between two adjacent discs 154 in their opened position, and shifting of the discs into their closed position results in the gripping of the hair 162 by the discs. The construction and operation of such a discs-based hair gripping device are also known *per se* and need not be more specifically described.

The device 800 is provided with a spacing layer 150 in zones of direct contact of the device with a skin surface 160. An appropriately designed flat tip 156 or other vibration conducting element holds the discs 154, and is formed with a screw member 158 for coupling the tip to a horn of a vibration generator, which is not specifically shown. The provision of the screw member 158 is optional and it can be replaced by a transducer directly attached to the vibration conducting element 156. However, the member 158 might also be an acoustic transducer. Further optionally provided in the device 800 is a side transducer 164 that operates the opening and closing of the discs 154, and further provides actual vibration of the trapped hairs 162. The entire system 800 is isolated from the skin 160 by the vibration buffers 150.

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Fig. 9 illustrates an epilation device 900 having a clip member 202 activated by a spring 200 for pivotal movement about an axis 206 with respect to a tip element 204. The distal end of the clip 202 is formed with a gripping part 208 projecting from the clip 202 towards the tip 204. The clip member 202 is shiftable between its normally closed position and opened position against the tension of the spring 200. In the opened position of the clip member, a hair shaft 216 can be inserted into a space between the gripping part 208 and the tip 204. When the clip member 202 is shifted into its closed position, the gripping part becomes retracted towards the tip 204 thereby clamping the hair shaft 216 between the clip and tip.

It should be noted that the clip member 202 could be located on an "envelope" not touching the tip end. The gripping part 208 is made of a material having special characteristics enabling the fastening of the hair and vibration of at least a portion of the clip together with the tip. In other words, the clip is sufficiently firm to grasp the hair, while being sufficiently flexible to enable its vibration with the tip.

A spacing layer 210 is provided within the zone of direct contact of the device with a skin surface 217. When the hair shaft 216 is fastened by the clip and tip, the vibrations of these parts are transferred to the hair bulb 212, thereby creating effect at the desired location and facilitating aspects of the hair removal from papillae 214.

Figs. 10A and 10B illustrate a device 1000 for hair removal in two different operational position of its gripping unit, respectively. The gripping unit is composed of a tip 220 and a strong leaf spring 222. The spring 222 is connected to the tip 220 via a surface 224 of a direct part 226 of the spring. Two wings 228 and 230 of the spring are flexible, and are shiftable between their opened position (Fig. 10A) and closed position (Fig. 10B) by rotation of prism 238 about an axis 236. During the operation of the device, the spring 222 does not contact the prism 238 due to air gap 240 surrounding the prism. Distal parts 232 and 234 of the wings 228 and 230, respectively, are intended to catch hair 244 (Fig. 10B). An outer sleeve

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242 prevents the hands of an individual (a medic, cosmetician, etc) from touching the vibrating tip 220.

As illustrated in Fig. 10B, the rotation of the prism 238 causes enlargement of the space between the wings 228 and 230. Accordingly, the distance between the distal parts 232 and 234 is increased, thereby enabling the entrance of the hair shaft 244 into the space between the wings' ends. Further rotation of the prism 238 results in the closing of the wings and gripping of the hair or hairs to be treated.

It should be noted that the gripping device could utilize two brushes movable along an axis. The gripping device can be used as a stand-alone hair removal device, or in combination with other hair removal devices utilizing any suitable hair removal technique.

Figs. 11A-11F schematically illustrate a hair gripping and skin stretching device 1100 constructed and operated according to the invention. Figs. 11A and 11D showing, respectively a cross-sectional view and a bottom view of the device, correspond to an inoperative position of the device. Figs. 11B and 11E show, respectively, a cross-sectional view and a bottom view of the device 1100 at its initial operational stage. Figs. 11C and 11F demonstrate the device 1100 during vibrating, by e.g., sonication, of hair 1024.

The device 1100 comprises a tip 1002 formed with preferably equally spaced grooves 1010 and arms 1004, and has a central groove 1020 for receiving the hair 1024 therein. Each groove 1010 contains a corresponding one of skin-stretching legs 1006, whose distal end is formed with a legs-attachment disk 1008. The arms 1004 are displaceable between their opened and closed positions. The opening of the arms 1004 causes a downward movement of the legs 1006 along the axes of the grooves 1010 towards a skin 1022, which movement is limited by stoppers 1012 installed in the preferably equally spaced grooves 1010.

As shown in Figs. 11A and 11D, in the inoperative position of the device, the tip 1002 is not brought in contact with the hair 1024. The skin-stretching legs 1006 are in their retracted, upper position in the grooves 1010, the legs-attachment disks 1008 not touching the skin surface 1022. At this position, the arms 1004 are

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located close to each other, and the central groove 1020 is rather closed. The stoppers 1012 do not affect the legs 1008.

As shown in Figs. 11B and 11E, when the device 1100 is put in operation, the arms 1004 of the tip 1002 are shifted into their opened position. Simultaneously  
5 with the opening of the arms 1004, the legs 1006 moves downward into their projected position controlled by the stoppers 1012. The central groove 1020 becomes larger so as to harbor the hair 1024 attached to the skin 1022. Comparing the position shown in Fig. 11E to that of Fig. 11D, it is clear that the movement of the arms 1006 with the disks 1008 attached to the skin 1022 stretches the skin.

10 As shown in Figs. 11C and 11F, further displacement of the arms 1004 (with the hair 1024 located therebetween) into their closed position, results in the closing of the central groove 1020 so as to grip/trap the hair 1024. In this position of the device, the legs 1006 carrying the disks 1008 are locked by the stopper 1012. It should be understood, although not specifically shown, that during this process of  
15 closing the arms 1004, the distance between the end of the tip 1002 and the skin 1022 becomes larger, thereby enforcing tension on the gripped hair 1024. The legs 1006, which stretch the skin zone around the hair 1024, are prevented from being retracted back into the grooves 1010 by the stoppers 1012.

Those skilled in the art will readily appreciate that various modifications  
20 and changes can be applied to the preferred embodiment of the invention as hereinbefore exemplified without departing from its scope defined in and by the appended claims.

In the method claims that follow, alphabetic characters used to designate claim steps are provided for convenience only and do not imply any particular  
25 order of performing the steps.

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**CLAIMS:**

1. A method for improving a hair removal process performed by a hair removal system, the method comprising the steps of:
  - (a) selecting a hair to be removed;
  - 5 (b) generating vibrations having predetermined frequency, amplitude and power, and transmitting said vibrations to a treatment zone;
  - (c) maintaining said vibrations of the treatment zone for a time sufficient to cause a desired effect at the treatment zone.
2. The method according to Claim 1, wherein the selection of the hair to be  
10 removed is performed by mechanical gripping of said hair.
3. The method according to Claim 1, wherein said treatment zone includes at least one of the following list: any hair component, any of the hair supporting elements, a skin portion around the hair to be removed, and any morphological structure which contribute to the vitality of the hair.
- 15 4. The method according to Claim 1, wherein said desired effect includes at least one of the following effects: loosening, destruction, degeneration or fatigue of at least a part of the treatment zone, and hampering of the morphology or physiology of at least one component of the treatment zone.
5. The method according to Claim 1, wherein said desired effect is reduction of  
20 pain caused by a hair removal process.
6. The method according to Claim 1, and also comprising the step of removing the hair.
7. The method according to Claim 6, wherein said step of removing the hair is performed after applying said vibrations to the treatment zone.
- 25 8. The method according to Claim 6, wherein said step of removing the hair is performed simultaneously with the vibrations to the treatment zone.
9. The method according to Claim 6, wherein the step of removing the hair comprises generation and transmission of radiation.
10. The method according to Claim 9, wherein said generation and transmission  
30 of radiation utilizes affecting the hair by RF radiation.

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11. The method according to Claim 6, wherein the step of removing the hair utilizes an electro-epilation process.
12. The method according to Claim 9, wherein said generation and transmission of radiation utilizes an application of microwave energy.
- 5 13. The method according to Claim 9, wherein said generation and transmission of radiation utilizes an application of light energy.
14. The method according to Claim 12 or 13, wherein said step of removing the hair is performed prior to the transmission of the vibrations to the treatment zone.
15. The method according to Claim 6, wherein the step of removing the hair  
10 utilizes mechanical plucking thereof.
16. The method according to Claim 1, wherein said predetermined amplitude is substantially more than 50 microns.
17. The method according to Claim 1, wherein said predetermined frequency is in a range of 10Hz to 100kHz.
- 15 18. The method according to Claim 15, wherein said mechanical plucking is performed by a mechanical hair removing system, said predetermined frequency preferably being 10 times higher than an operational frequency of the hair removing system.
19. The method according to Claim 1, wherein said time sufficient to cause the  
20 desired effect is preferably from second parts till seconds.
20. The method according to Claim 1, and also comprising the step of stretching a skin portion in the vicinity of the treatment zone.
21. The method according to Claim 1, and also comprising the step of treatment of the hair performed prior to or concurrently with the transmission of said  
25 vibrations to the treatment zone.
22. The method according to Claim 21, wherein said treatment comprises tensioning of the hair.
23. A device for improving a hair removal process performed with a hair removal system, the device comprising a hair selecting means for affecting a  
30 selected hair to be removed, and a vibration generator that generates vibrations



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having predetermined frequency, amplitude and power, and transmits said vibrations for sufficient time to a treatment zone, such as to cause a desired effect at the treatment zone.

24. The device according to Claim 23, wherein said treatment zone includes at least one of the following list: any hair component, any of the hair supporting elements, and a skin portion around the hair to be removed, and any morphological structure which contribute to the vitality of the hair.

25. The device according to Claim 23, wherein said desired effect includes at least one of the following effects: loosening, destruction, degeneration or fatigue of at least a part of the treatment zone, and hampering of the morphology or physiology of at least one component of the treatment zone.

26. The device according to Claim 22, wherein said desired effect is reduction of pain caused by said hair removal process.

27. The device according to Claim 23, wherein said vibration generator is engageable with the hair selecting means associated with an effective epilation compartment capable of performing the hair removal process.

28. The device according to Claim 27, wherein said hair selecting means includes a hair gripping device.

29. The device according to Claim 28, wherein said hair gripping device with the effective epilation compartment form together a mechanical hair removal system.

30. The device according to Claim 29, wherein said vibration generator is accommodated in a housing capable of engaging said mechanical hair removal system.

31. The device according to Claim 30, and also comprising a vibration absorber element that at least partly absorbs the vibrations of said housing.

32. The device according to Claim 29, wherein said vibration generator is integral with the mechanical hair removal system.

33. The device according to Claim 23, and also comprising said hair removal system.

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34. The device according to Claim 23, wherein said hair removal system comprises radiation generation and transmission means.

35. The device according to Claim 34, wherein said radiation generation and transmission means comprises an RF means.

5 36. The device according to Claim 35, wherein said vibration generator is coupled to the RF transmitting unit.

37. The device according to Claim 33, wherein said hair removal system comprises an electro-epilation means.

38. The device according to Claim 34, wherein said radiation generation and  
10 transmission means comprises microwave energy generating and transmitting means.

39. The device according to Claim 34, wherein said radiation generation and transmission means comprises light energy generating and transmitting means.

40. The device according to Claim 34, wherein said radiation generation and  
15 transmission means comprises ultrasound energy generating and transmitting means.

41. The device according to Claim 28, wherein said hair gripping device comprises tweezers arms pivotal between their opened and closed position to receive and clamp the hair therebetween.

20 42. The device according to Claim 28, wherein said hair gripping device comprises spaced-apart parallel disks shiftable between their opened position, in which the space between the adjacent disks serves for trapping the hair, and their closed position, in which the hair is clamped by the disks.

43. The device according to Claim 28, wherein said hair gripping device  
25 comprises a tip-like element associated with the vibration generator, and a clip-like element coupled to the tip via a spring, the clip being shiftable between its closed and opened position with respect to the tip against the tension of the spring.

44. The device according to Claim 28, wherein the hair gripping device comprises a strong leaf spring connected to a tip of the vibration generator, the

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spring wings being flexible and shiftable between their opened and closed positions.

45. The device according to Claim 28, wherein the hair gripping device is integral with the vibration generator, the device comprising a tip formed with spaced-apart grooves and arms, and a skin stretching means mounted for sliding movement along the grooves, displacement of the arms between their opened and closed positions enabling the hair to be clamped in a central groove and causing a downward movement of the skin stretching means towards the skin.

46. A vibration generator engageable with a mechanical hair removal system, that has a hair gripping means and an effective epilation compartment and is capable of performing a hair removal process, wherein the vibration generator is capable of generating vibrations of predetermined frequency, amplitude and power, and transmitting said vibrations towards a treatment zone, such as to cause a desired effect at the treatment zone.

47. The vibration generator according to Claim 46, wherein said treatment zone includes at least one of the following list: any hair component, any of the hair supporting elements, and a skin portion around the hair to be removed, and any morphological structure which contribute to the vitality of the hair.

48. The vibration generator according to Claim 46, wherein said desired effect includes at least one of the following effects: loosening, destruction, degeneration or fatigue of at least a part of the treatment zone, and hampering of the morphology or physiology of at least one component of the treatment zone.

49. The vibration generator according to Claim 46, wherein said desired effect is reduction of pain caused by said hair removal process.

50. The vibration generator according to Claim 46, wherein said hair gripping means comprises tweezers arms pivotal between their opened and closed position to receive and clamp the hair therebetween.

51. The vibration generator according to Claim 46, wherein said hair gripping means comprises spaced-apart parallel disks shiftable between their opened

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position, in which the space between the adjacent disks serves for trapping the hair, and their closed position, in which the hair is clamped by the disks.

52. The vibration generator according to Claim 46, wherein said hair gripping means comprises a tip-like element associated with the vibration generator, and a clip-like element coupled to the tip via a spring, the clip being shiftable between its  
5 closed and opened position with respect to the tip against the tension of the spring.

53. The vibration generator according to Claim 46, wherein the hair gripping means comprises a strong leaf spring connected to a tip of the vibration generator, the spring wings being flexible and shiftable between their opened and closed  
10 positions.

54. The vibration generator according to Claim 46, wherein the hair gripping means is integral with the vibration generator, the device comprising a tip formed with spaced-apart grooves and arms, and a skin stretching means mounted for sliding movement along the grooves, displacement of the arms between their  
15 opened and closed positions enabling the hair to be clamped in a central groove and causing a downward movement of the skin stretching means towards the skin.

55. A method for decreasing the amount of pain sensed from a skin from which hair is to be removed, the method comprising the steps of generating vibrations of predetermined frequency, amplitude and power and transmitting said vibrations  
20 towards the skin during a sufficient time period such as to cause at least partial numbing of the pain sensed from the skin.

56. A device for decreasing the amount of pain sensed from a skin from which hair is to be removed, the device comprising a vibration generator, generating vibrations of predetermined frequency, amplitude and power, and coupled to a  
25 skin-contacting member for transmitting said vibrations towards the skin such as to cause at least partial numbing of the pain sensed from the skin.

57. The device according to Claim 56, and also comprising a hair treatment means for treatment of the hair prior to or concurrently with the transmission of said vibrations towards the skin.

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58. The device according to Claim 57, wherein said hair treatment means comprises tensioning means for tensioning the hair.

59. The device according to Claim 58, wherein said tensioning means comprises gels.

5 60. The device according to Claim 56, and also comprising a skin treatment means for treatment of the skin prior to or concurrently with the transmission of said vibrations towards the skin.

61. The device according to Claim 60, wherein said skin treatment means comprises stretching means for stretching the skin to reduce absorption of  
10 mechanical energy in the skin.

62. The device according to Claim 60, wherein said skin treatment means comprises cleaning means for cleaning the skin surface to reduce absorption of mechanical energy in the skin.

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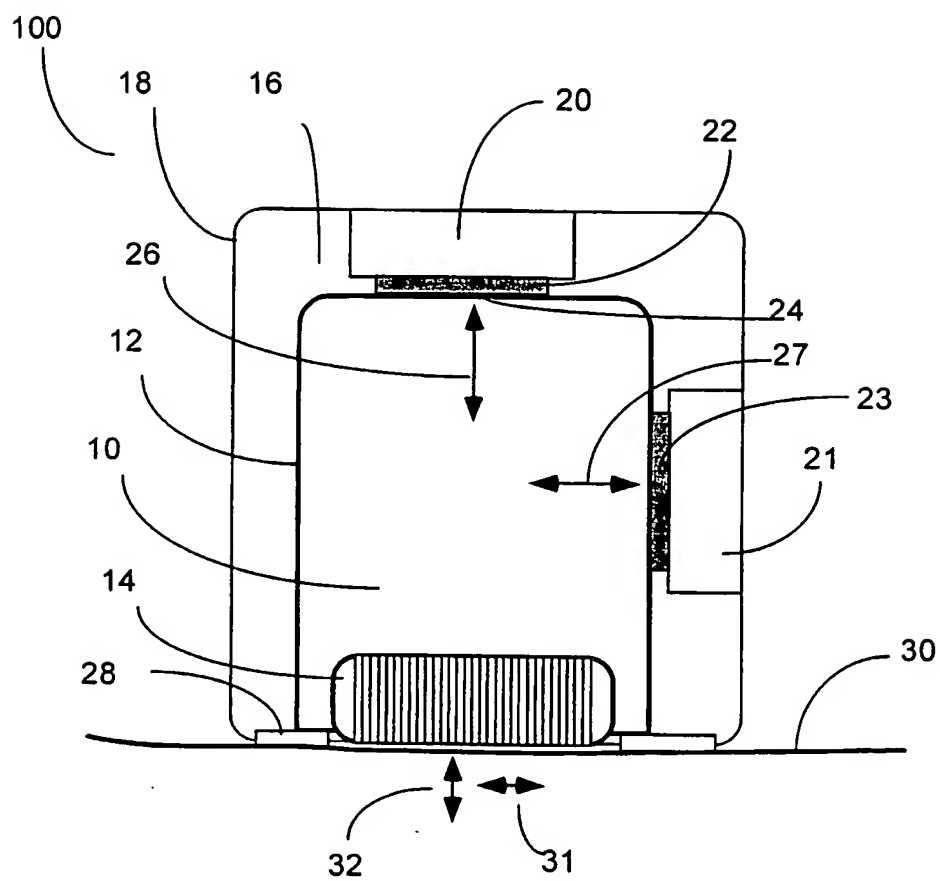


Fig 1.

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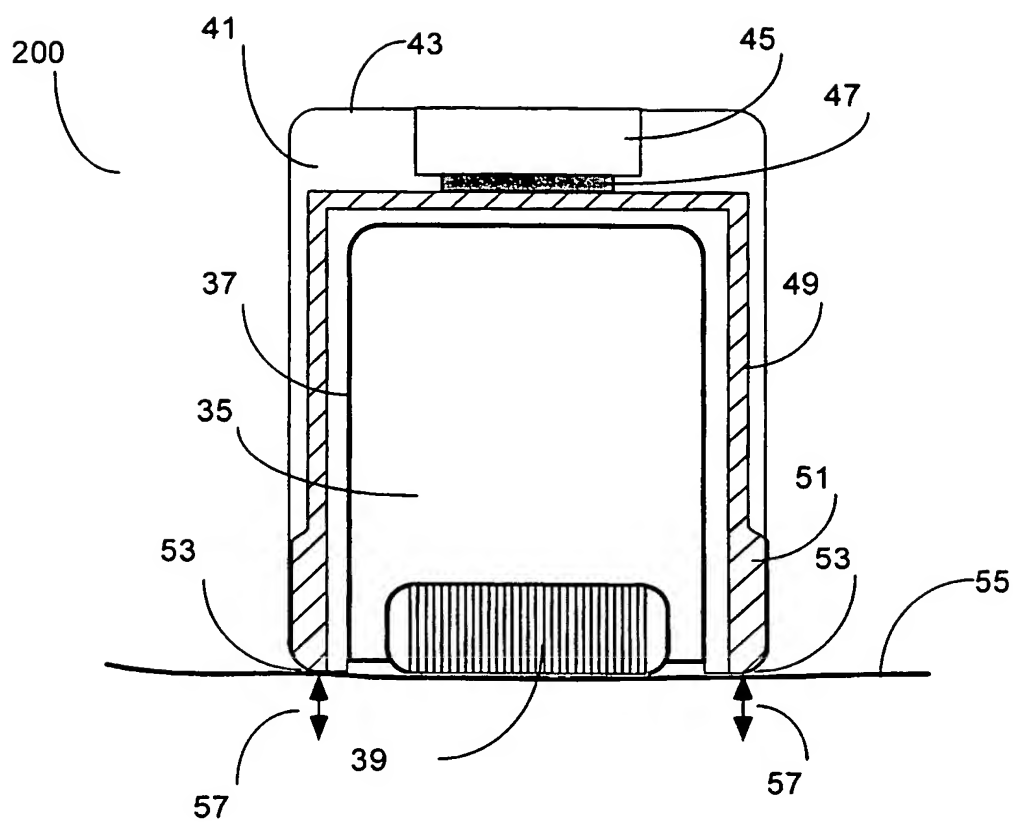


Fig 2.

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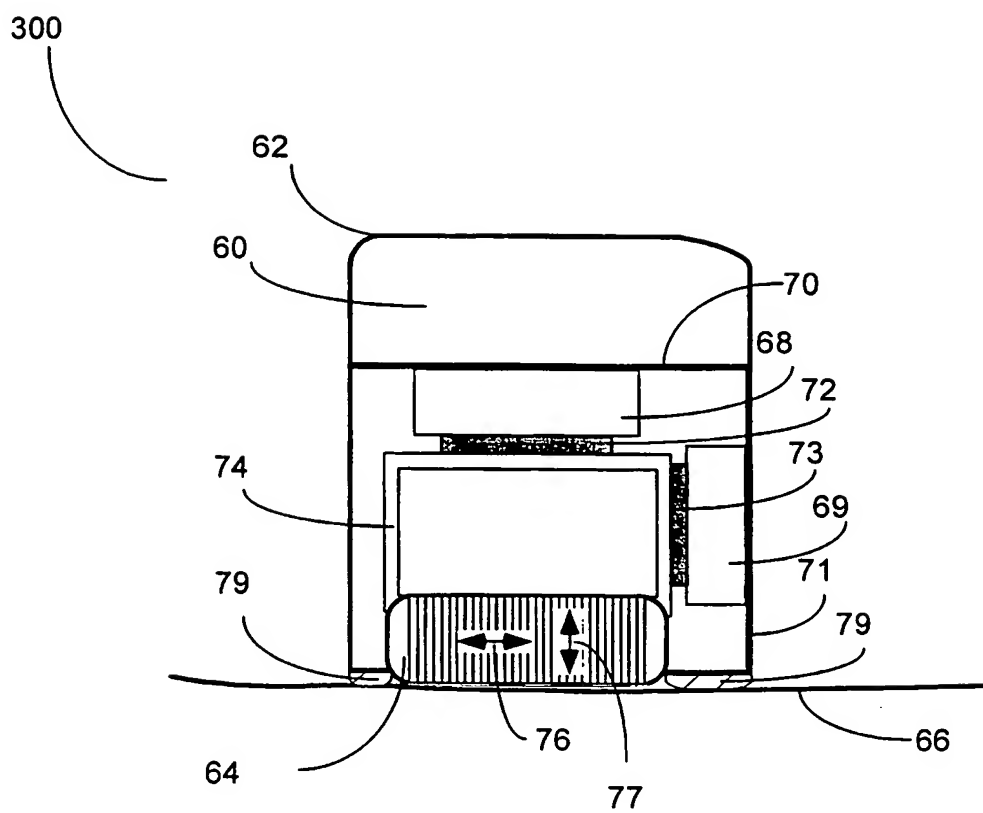
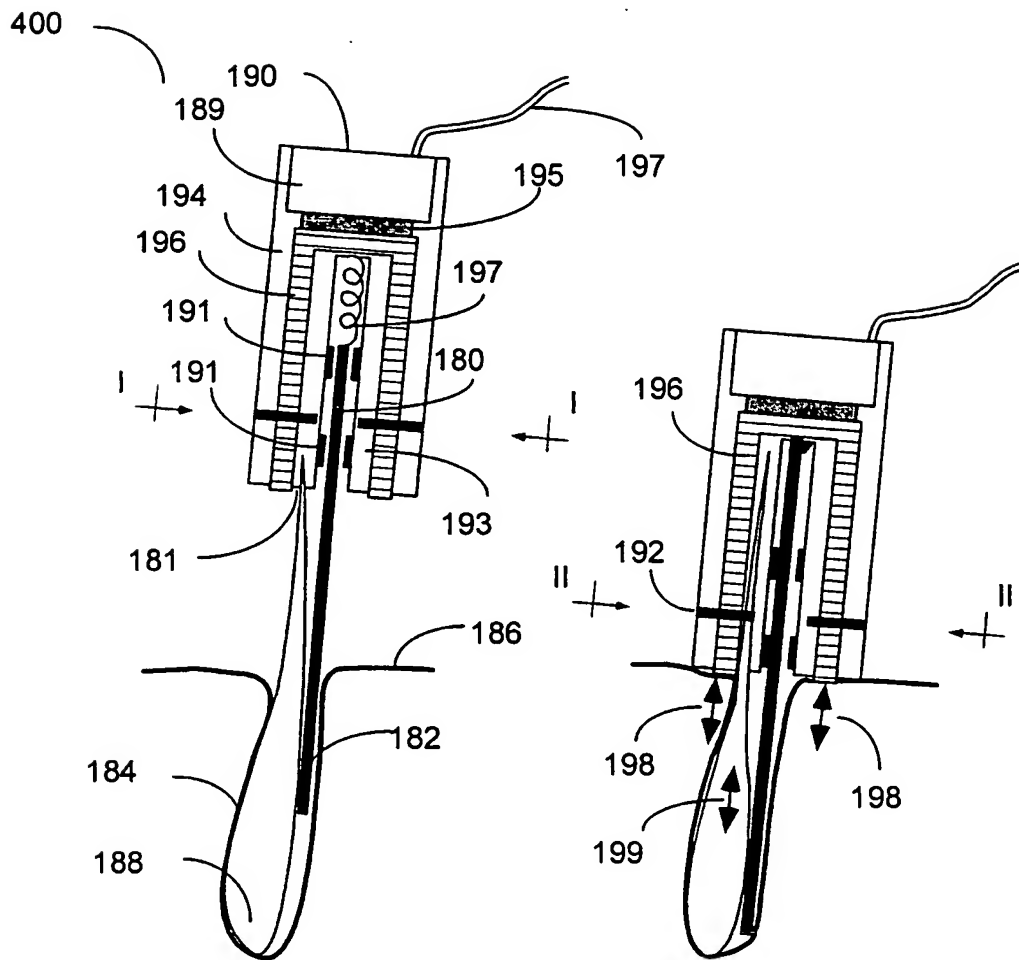


Fig 3.

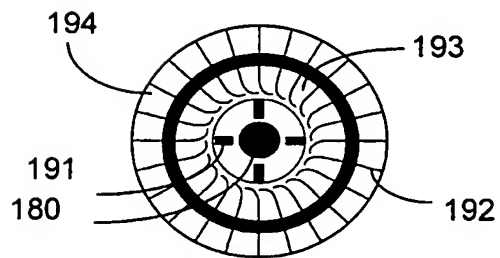


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**Fig.4A**

**Fig 4B**



**Fig4C**

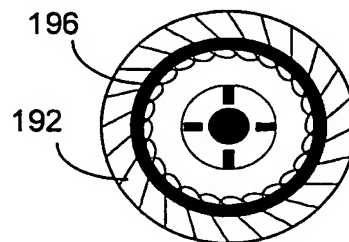


Fig4D

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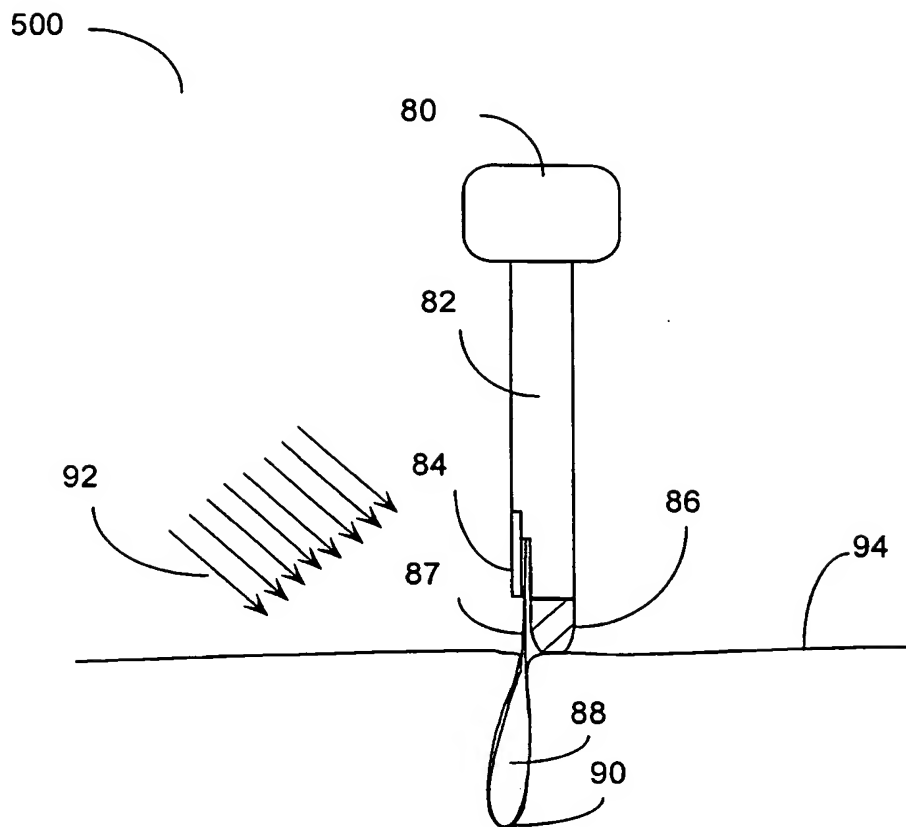


Fig 5.

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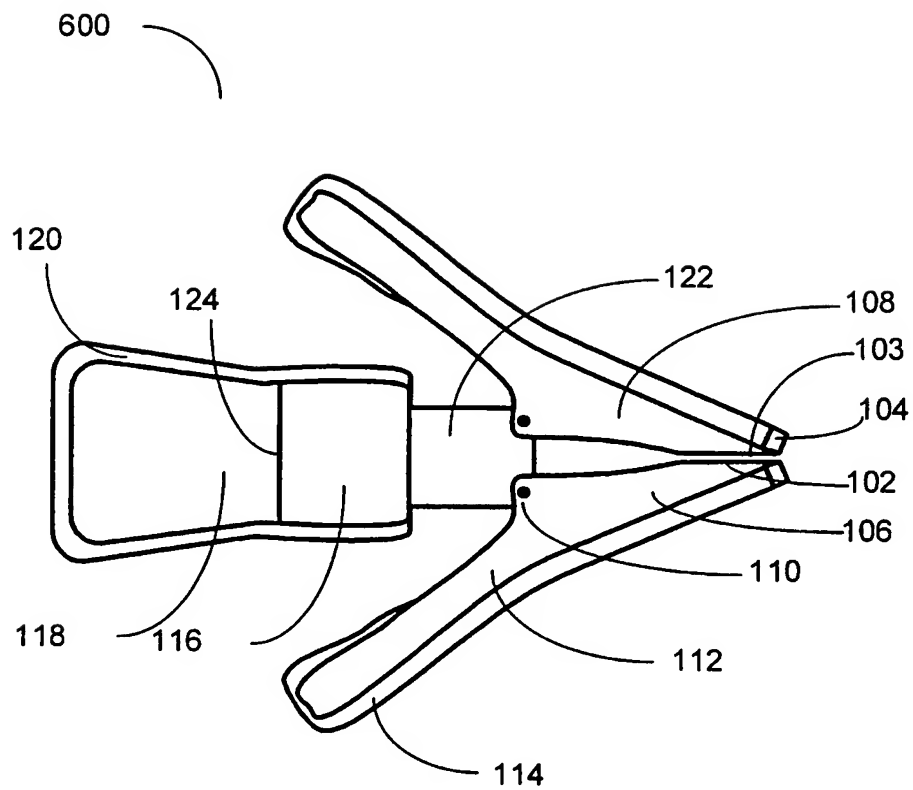
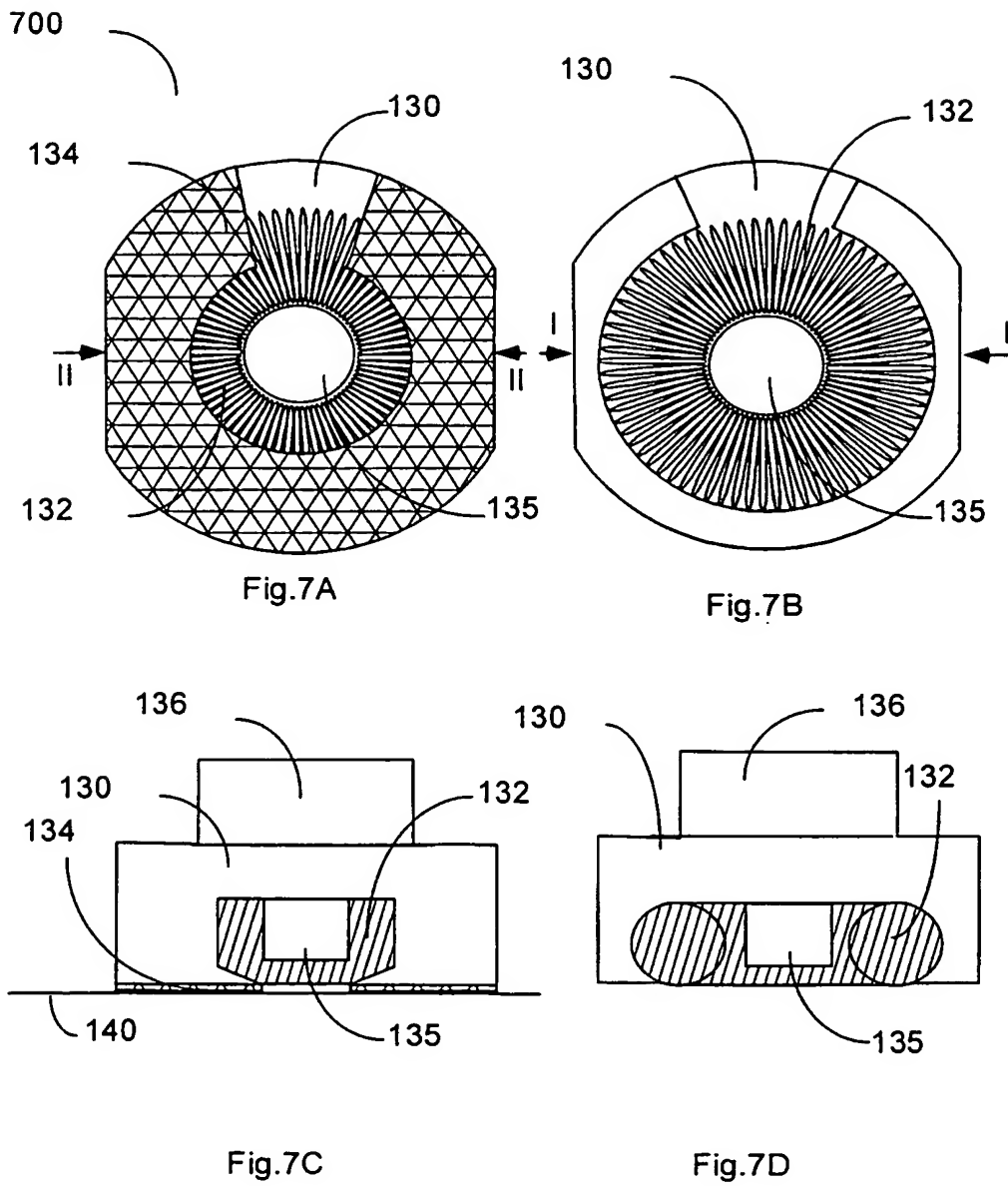


Fig. 6

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800

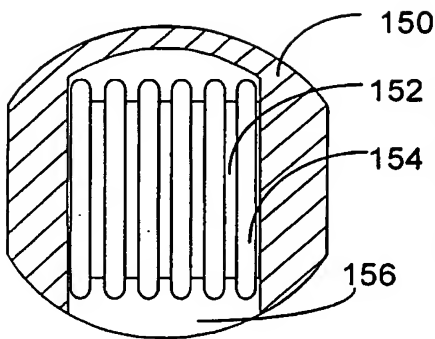


Fig. 8A

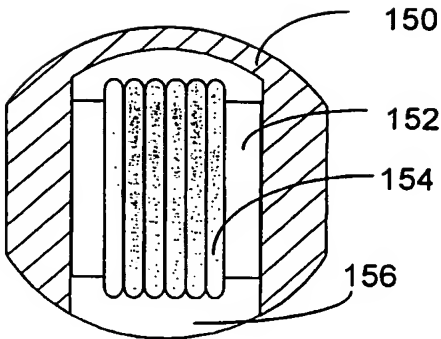


Fig. 8B

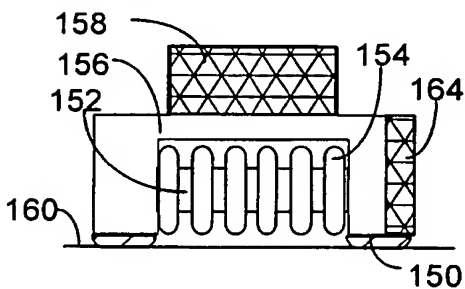


Fig. 8C

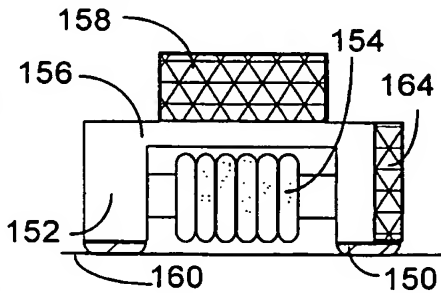


Fig. 8D

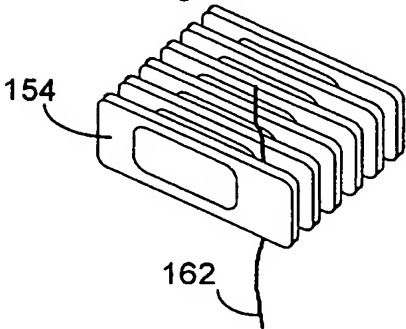


Fig. 8E

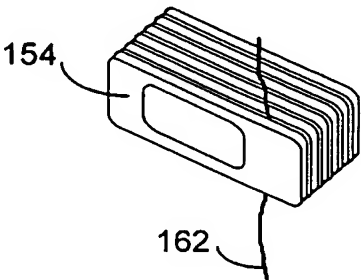


Fig. 8F

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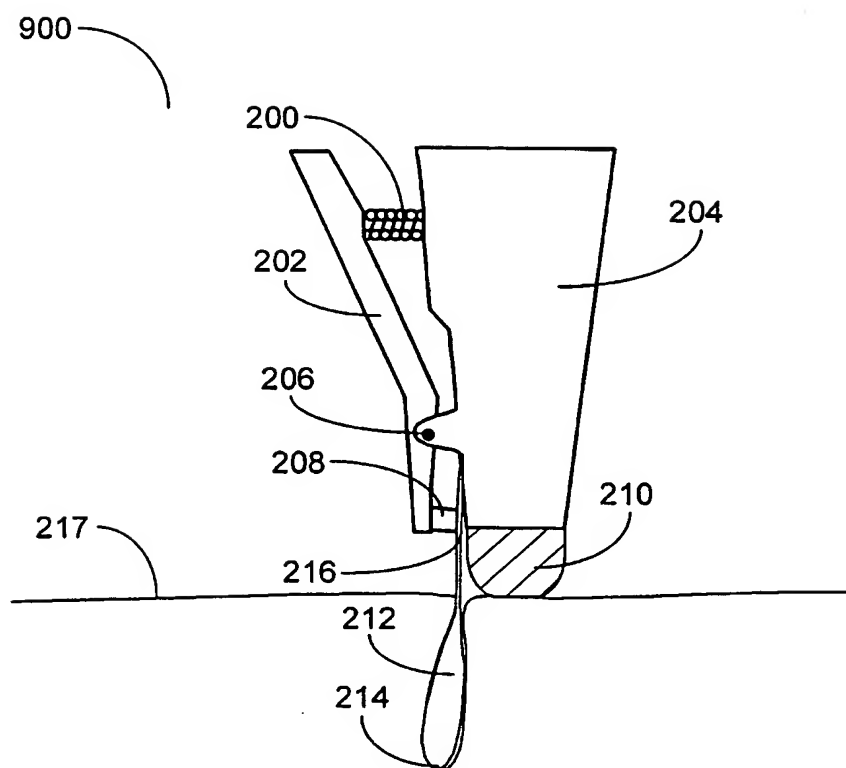
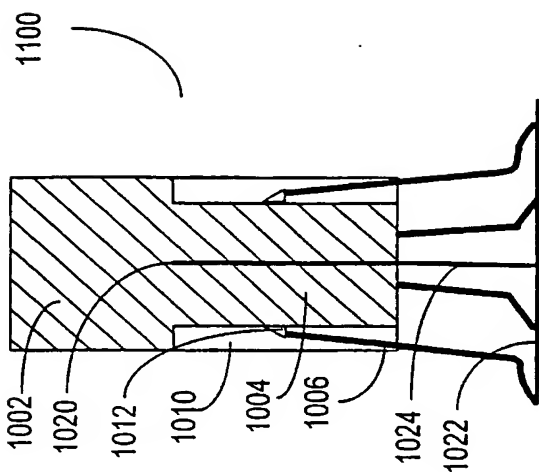
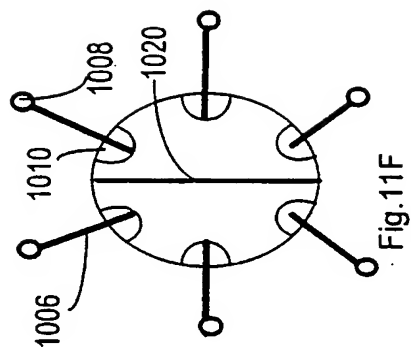


Fig. 9

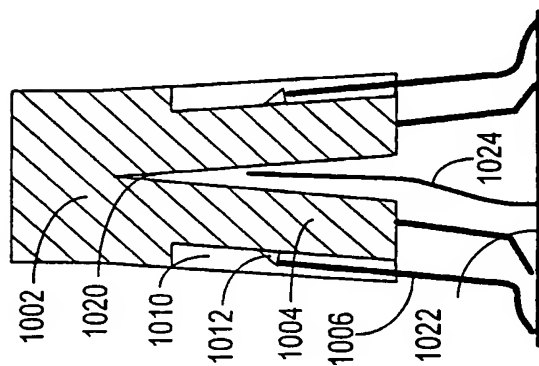
**Fig.10B**



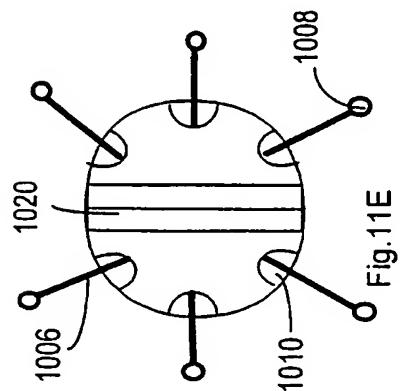
**Fig. 11C**



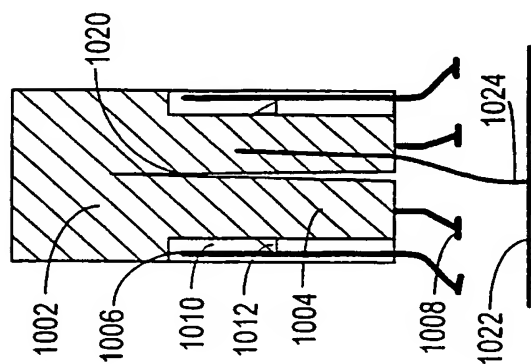
**Fig. 11F**



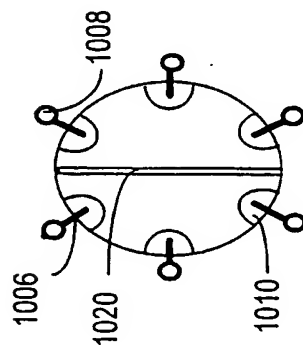
**Fig. 11B**



**Fig. 11E**



**Fig. 11A**



**Fig. 11D**



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/IL 00/00732

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A45D26/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 A45D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

PAJ, EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	PATENT ABSTRACTS OF JAPAN vol. 015, no. 048 (C-0802), 5 February 1991 (1991-02-05) & JP 02 279107 A (HOOMAA ION KENKYUSHO:KK), 15 November 1990 (1990-11-15) abstract  ---  -/--	1-8, 15, 23-30, 32, 33, 41, 46-50, 55, 56

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

27 February 2001

Date of mailing of the international search report

05/03/2001

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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL 00/00732

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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International Application No

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